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tration league would extend around the world among the advanced nations.

This third shape of the reform would enable us to begin to think of a still higher level of improvement, or what I call Disarmed Arbitration. The Emperor of Russia, in his call for the Hague Convention, said much about disarmament, and put it in the forefront of his proposition. His action looked like driving the wedge thick end foremost. Disarmament is naturally a final, almost never a fit initial, measure. We have driven in the thin end of the wedge now, and more than the thin end. We are likely to get to a serious discussion of Dudley Field's plan by and by. We may come at last to the level at which arbitration will demand disarmament, or at least a diminution of the size of armies and war budgets. As this has been discussed for centuries by great experts, as it was brought forward at The Hague, we must keep it in mind in view of the future into which we are drifting, and in which we ought to have clear ideas of this reform which we have been blessed by Providence with permission to initiate.

Unless God stands above all these lower and higher levels of arbitration, they are as vain as telegraphic lines without the electric current. I put above them all what I love to call Christian Imperialism, the purpose of uplifting humanity, the mood which sends missionaries to the ends of the earth, the inspiration from on high of which my theistic Hindoo friend, Mozoomdar, spoke eloquently here last night. He told us in his figurative way that until a theocracy governs the earth our democracy is little better than chaos. Why, we need to sow this land ankle deep with documents concerning arbitration! And let not the churches think they have no responsibility in this matter. They are to interpret the thought of God; for it is only from the rains, only from the light, coming from above, that we shall make Christian Imperialism a success, or give anything like vitality to the hopes that Victor Hugo and Tennyson express.

Good poetry ought to be good sense, as well as lofty in its appeal to the love of the beautiful and the sublime. Tennyson's words are grand and beautiful, and are also good sense; but the most important line in the famous passage is rarely quoted:

"Then I dipped into the future, far as human eye could see,
Saw the Vision of the world, and all the wonder that would be;
". . . 'Till the war-drum throbbed no longer, and the battle-
flags were furled
In the Parliament of Man, the federation of the world.

"*There the common-sense of most shall hold a fretful realm in awe,*
And the kindly earth shall slumber, lapped in universal law."

"There?" Where? In the "Parliament of Man, the federation of the world." By federation he does not mean consolidation; he would not cut up by the roots national patriotism. He would not have such a union of the nations as would prevent a man from saying, "I am an Englishman," "I am a German," or "I am an American." Daniel Webster once said, "Our states are united, not consolidated." Tennyson means that among the nations there shall be such an arrangement as Confederate Arbitration. How are we to hold nations in times of great stress and tumult, when greed seizes upon the heart-strings and they will have war at any price, and rush headlong into any kind of peril? How are we to

hold them? By David Dudley Field's Confederate Arbitration, or by such alliance of a moral and legal kind among the nations as shall give the "common-sense of most" the power to "hold a fretful realm in awe." I ask young men in America,—I strenuously urge all who are to be Pilgrim Fathers of the twentieth century,—to study the higher levels of arbitration, until they come, as a fixed habit of mind, to demand Christian Imperialism, to demand it in the face of Cormorant Imperialism everywhere, to demand it in the face of a Jackal Jingoism, to demand it in the press, to demand it in the pulpit, to demand it on the platform, to demand it in the schools, to demand it as authors, as statesmen, and even as politicians.

"All the armor of the booted warrior in the tumult
And the garments rolled in blood
Shall be for burning
And for fuel of fire.

"FOR unto us a child is born,
Unto us a Son is given;
And the Government shall be upon His shoulder,
And His name shall be called Wonderful,
Counsellor, Mighty God,
Everlasting Father, Prince of Peace.
Of the increase of His Government
And of Peace there shall be no end. . . .
The zeal of the Lord of Hosts shall perform this."

—Isaiah ix. (R. V. text and margin.)

The Influence of Mechanical Science on the Social Condition of Humanity.

BY EDWARD ATKINSON.

Proposed for submission to the American Association for the Advancement of Science, June, 1900.

I have been requested to submit a paper on the foregoing subject. In compliance with that request I offer the following views on only one department of Mechanical Invention.

We can readily conceive the human race wandering over vast spaces in prehistoric ages, few in number, each family living on the spontaneous products of the soil, without knowledge of how to make fire and without any mechanical appliances or tools. We can imagine what happened when the first man who had invented a flint spear head found out that it gave him greater power. Presently the art of keeping fire alive was devised, later the art of making fire; then the art of cooking was discovered, and the man who could make flint spear heads with which to provide the most food energy to his body took a dominant position. Presently the arrow was invented which was discharged from some kind of bow, the gut of animals coming into use for bow strings.

The first man who excelled in these arts became capable of exerting power not only over the beasts of the field and the forest, but over his neighbors. Doubtless he assumed that power. Tribal organization then came into existence. The superiority of the tribe that had invented tools over those who had not became manifest. Distribution by force, plunder and rapine, the stronger controlling the weaker and less intelligent, evidently became a rule in the primary organization of society. New social conditions have been developed with every mechanical invention applied to killing implements. Presently emerged the art of war. The warrior became the chief, free of labor; the woman becoming a beast of

burden. As time went on new inventions in the art of killing and in the organization of armed forces were developed, and with their progress, tribes, races and states gained control over others according to their superiority in mechanical invention applied to the art of war.

Progress was presently made in substituting slavery for slaughter; captured persons were made useful, while the military caste grew more and more arrogant in their contempt for the arts of peace. The feudal system ensued over a large part of Europe. The man in armor, knight, earl, duke, king and the like, was enabled by mechanical invention applied to making armor and killing implements to subjugate the common people to his sway.

NEW INVENTIONS IN THE ART OF WAR.

As time went on new mechanical and constructive inventions were applied in the art of war, the building of castles proof against anything but gunpowder. The robber barons were thus able to hold in subjection great areas of country. But even before the invention of gunpowder several mechanical appliances had tended to reduce the power of the man in armor. The cross bow, capable of sending an arrow but a short distance, had not overcome the power of the man in armor. The long bow went a step further and had nearly unhorsed the knight, enabling well-armed infantry, especially the Swiss, to overcome the power of the petty dukes and knights, who only gave up fighting among themselves and united under one leader for a time in order to continue their oppression of the subject masses. The military caste used every possible effort to suppress invention and to keep the control over the common people; but presently came the invention of gunpowder, the most effective invention in changing the social conditions yet developed. It must have been very unpleasant to the feudal chieftain, mounted and clad in complete armor, to have a bullet put through the iron pot with which his head had previously been protected. Doubtless his assumption of superior intelligence and right to govern was profoundly shaken by the first bullet which unhorsed him.

We witness in the records of war the constant efforts of the military caste to degrade the tradesman and the mechanic, to keep them in subjection, and as far as possible to prevent the application of invention that might in any way render the man at arms equal to the members of the military caste by whom armies were organized. Had the common school been earlier established, and had common intelligence and instruction accompanied progress in the mechanical art of killing, war would long since have become impossible. War is generated in ignorance, ambition and greed.

It is only by base appeals to bad motives that the military caste and the privileged classes can now array the privates of different countries and races against each other. It is only by appeals to ignorance and prejudice that private soldiers can be induced to fight, who would otherwise live in a condition of peace, order and mutual service.

ART OF WAR IN THIS CENTURY.

The fine art of war, *alias* killing, has been developed with greater rapidity in the nineteenth century than ever before, until we are almost at the point when it will

become so uncertain which of any two naval vessels or armies in battle array will be quickly destroyed as to make it bad policy to bring them very near each other, especially since the improvement of rifles has made it certain that unless the officers disguise themselves as privates and fall into the ranks they will be the first to be hit. Under these conditions war may become as absurd, ridiculous and archaic as it is ghastly, atrocious and beastly in its immediate effects.

A little over one hundred years ago Immanuel Kant published his great essay on Eternal Peace, in which he laid down the principle in the following paraphrase: "Seek ye first the kingdom of pure practical reason and its righteousness, and then will your object, the benefit of perpetual peace, be added unto you."

In the light of pure reason is not all war due to ignorance or imbecility? What could be more grotesquely horrible than the pictures in the London *Graphic* of Englishmen and Boers meeting to bury the dead or holding friendly intercourse while succoring the wounded; then obeying the orders to shoot each other in a contest in which their own welfare is sacrificed either to the greed, the ambition or the incapacity of the leaders on both sides?

Kant's essay rests upon the belief that men in civil life had attained sufficient intelligence to stop the privileged classes from substituting a war of tariffs for a war of armies. It could not have occurred to a man of such power of thought as Kant, that men and nations, after having attained a vision of liberty, of peace, of order and of mutual service, could be so misled as to pervert the power of taxation to purposes of private gain. Yet this phase of economic folly had to be passed through during the last hundred years, and has not yet spent its force.

INVENTORS IN THE ART OF WAR CIVILIANS.

There has been, however, a yet more potent force exerted by mechanics in pursuit of gain, which may put a stop to war sooner than the practice of regular commerce may do so. It will be observed that all the great recent inventions in the art of war have been made by civilians; that is to say, by mechanics occupied in the pursuit of gain. Some minor inventions have been made by military men, but all the great inventions merely need the name of the inventors to be given to prove that the men of sufficient capacity to make great inventions in mechanical appliances have never taken to the pursuits of militarism. They have employed their tools to their own benefit, but have left it to others to apply them in the art of killing. Witness the list of great inventors: Whitney, Krupp, Remington, Maxim, Ericsson, Whitehead, Walmsley, Nordenfeldt, Hotchkiss, Colt, Mauser, Winchester, Armstrong, Laird, Gatling, Crump, Holland and all the rest—gun makers, ship builders and constructors of marine engines. Who invented the smokeless powder I know not; certainly not a military man.

It is a singular fact that the list of great soldiers and naval officers contains not one name of a great inventor in the military art, while the list of the great inventors of weapons and the constructors of naval vessels contains not a single name of any man who ever attained any considerable position in the use of their weapons or

their ships. Men of highest repute in their personal relations become officers in armies and navies, rendering as great service as men can render in wars which are in defense of liberty. Yet in this country, in which the principle of liberty and freedom from militarism has been more fully established than anywhere else, notwithstanding the present craze, men of inventive ability or of great administrative power find no permanent career either in the army or the navy. The service which they can render in occupations in which the leaders are sometimes called "captains of industry," and the rewards which they can readily attain in the arts of peace, draw them out of the army and the navy into the pursuits which contribute to the general welfare as well as to their own. The strictly military class, consisting of men who in foreign states can find no other career or who in this country choose and remain in the military profession, are seldom men of much capacity for other occupations. Many names will occur to you of those who had left the army and the navy before the Civil War, but who returned to it in defense of liberty. Many names could now be given of very able men who had left the destructive pursuits of the navy to take charge of great establishments of a constructive type.

INVENTIONS RESISTED BY MILITARY CLASS.

Any one who studies progress in the application of mechanical science to social conditions for the last one hundred years will find that the introduction of every one of these inventions in killing implements has been resisted for a time by the military classes. They have been very averse to changing their tactics and altering their military formations. They have not approved the necessity of giving up the leadership to the mechanics whom they have previously looked down upon as being engaged in a subordinate occupation. For instance, naval battles are no longer a question of seamanship: they have become a mere problem in engineering. The one who is sure to win in the naval contest is the one who has the best products of the mechanic arts in his ship and the most intelligent mechanics to work them. He must possess enough seamanship to get his ship into the right position, but there he gives way to the mechanic who works the whole interior mechanism of the vessel and its guns. Without the skilled engineer and mechanic the admiral is powerless.

It is to be hoped and may be expected that one or the other of the submarine boats now in progress of development by mechanics, and now being forced upon the naval officers of different countries against their will, will put all the modern battleships into a state of "innocuous desuetude." It is not a big job. None that have been in existence for more than ten years are now capable of any effective service, and all that are now being constructed will be relegated to the obscure harbors, like that of Bermuda, where they will not be within common view, even if the submarine boat is not already so well assured as to give them a safer position at the bottom of the sea. I went to Bermuda a few years since, where I found an out-of-the-way harbor to which Great Britain had sent the Confederate rams built by the Lairds during the Civil War, and a large number of out-of-date ironclads—in all about twenty-five million dollars' worth of old iron still in the form of ships that would not pay to

take to pieces. It is fortunate that we have no obscure harbor where our obsolete vessels can be concealed from public view. Our waste cannot be concealed.

A recent picture in the *Graphic and London News* illustrates a grotesquely funny way of disposing of waste in naval construction. One of the great iron-clad battleships of which Great Britain was so proud but a few years since is represented as a target fitted up with dummy guns and dummy men, possibly having cost a million dollars. Twelve hundred yards away one of the bigger ships, the "Majestic," probably costing three times as much, is pictured firing at the other with modern weapons. The report goes on to say that almost the first shot would have destroyed nearly the whole crew had there been any but dummy men in the target, and within a few minutes the great iron-clad master of the sea of but a few years since was reduced to a helpless wreck. How soon will the "Majestic" become a target? Perhaps in ten years more or less. But what a pity the experiment could not have been carried out to its conclusion, dummies taking the place of men on the "Majestic" and a little microbe or submarine boat, burrowing its way under the sea at a trifling cost, knocking a hole in her bottom and sending her also to "innocuous desuetude" at the bottom of the sea.

WAR VESSELS SOON WORTHLESS.

The people of Great Britain are now trying to find out how many old hulks are listed in the active force of the navy that are fit for nothing but targets; also how many of the newer battleships are fitted with boilers of a certain type which the navy department adopted to the exclusion of others but a few years since, which are now found to be all but worthless.

Spain had a great navy on paper. What part of the navies of other countries is now of any effective service? Possibly a considerable part of those which have been constructed within the last five years. Possibly those which are now on the stocks in this country, upon which the recent Congress, being incapable of reaching any sound conclusion, has put upon a Boston lawyer of fair repute in his profession, without any experience in metallurgy, the responsibility of deciding whether or not to spend \$500 a ton for thirty thousand tons of steel plate, say \$15,000,000 in all; while in another department of the government, known as the Ordnance Bureau, it is hoped that some new guns now being tested will render the \$15,000,000 worth of steel plates, or their counterparts on the ships of other countries, a useless encumbrance, of little avail in preventing the destruction of the ship from the shore batteries.

RETROGRESSION IN THE ART OF WAR.

The progress of invention in the art of killing has been accompanied by necessary retrogression in the conduct of war. In former times, when knight met knight face to face, there was an element of chivalry in the contest. When great forces met each other in battle array, manhood of a certain type was unquestionably developed. But as the mental energy of the inventor developed more effective and long-distance killing implements, calling for something more than mere courage in their use, the conduct of war was wholly changed. It no longer consists in an open or equal fight, but has degenerated into ambushing, spying, cheating, mislead-

ing and attacking in the back or on the flank. The fine art consists in getting a better gun or a more destructive implement, while depriving the opponent of an equal chance. Not only is the old battle array out of date, but every force now includes a great body of sharp-shooters whose business it is to get behind stones or heaps of dirt or up in a tree and to pick off the officers on the other side. Every trick and device that would be base in the conduct of commerce is not only justified, but is necessary in the conduct of war. What would dishonor a merchant gives glory to a general. The sagacious remark of a British officer regarding the Maxim gun is to the point. He said it was "the best gun for killing niggers that had ever been invented."

All wars are now wrong. They originate in a wrong attempted or done by one state or nation to another. Where the parties in any contest both act consistently with human rights, there can be no violence.

It is ignorance on the part of great masses of the people which betrays them to the false leaders who promote militarism, permit criminal aggression to be committed and unjustifiable wars to be conducted at their cost. But the progress which has put the tradesman and the mechanic in control of the art of war is gradually pervading great masses of the people of this country and of Europe, developing what has been called the "thinking bayonet." When the great body of the privates carry thinking bayonets, it will be useless for the military class to array them in contest with each other and order them to fight. They will rightly say, "We privates will not kill each other, and we refuse to engage in mutual slaughter. Our interests are the same. We desire to keep the peace and to exchange services, not bullets, each with the other. We mean to enjoy the abundance of modern life, free of the destructive taxation which you impose upon us."

POSSIBILITIES OF HIGH EXPLOSIVES.

I would not suggest to any of the masters of mechanical engineering here present to divert their attention from the kind of work in which they are now engaged, but if they can by the way improve rifles, guns or other killing implements or invent more destructive implements of war than have yet been devised, then Kant's vision of Eternal Peace may be realized sooner than most people anticipate. If we could only reach the point when whole fleets could be destroyed by a single impregnable and unsinkable warship, the peace of God might prevail upon the sea; and if an airship or some other invention may soon enable a few men from a high point of vantage to inflict the maximum slaughter on the opposing force, without loss to themselves, as in the late naval contest in Manila Bay, that will be a long step in overcoming the semibarbaric conditions of warfare as now conducted. Is there not reason to hope for these high attainments in the mechanic arts? You now have all the high explosives, with more yet to be invented. You have electricity, liquid air and other great forces on which only a beginning has been made in their application to the science of destruction. It may happen that ere long one of two results may occur in any given contest: First, both forces may be so completely shattered and destroyed as to disable both sides that engage in warfare without advantage to either; or, what we may

hope for especially in this country, the means of defense will become so absolute as to render an attack by any other state or nation a surely suicidal enterprise. The final ending will, however, come in the progress of the higher education which will render the art of war an ignoble, if not always an immoral, pursuit.

POWER TO ENFORCE ORDER.

It is not here asserted that the great progress which is now assured in making implements of war more destructive will lead to non-resistance, or that it will do away with the necessity of applying force to the maintenance of order. On the contrary, it will give to the great commercial states of the world, which are now beginning to witness the benefit and the necessity of the "open door" to commerce on equal terms for all nations, the power to enforce order and to compel submission to international agreements. The beginning may be made upon the high seas by abolishing privateering and making private property free of seizure. The United States, Great Britain, Germany, combined with Russia, may enforce these rules against all the lesser nations. Russia is entering upon a great industrial development and is eager to lessen the burden of militarism. What more reasonable than that these great commercial nations should enforce international peace upon the ocean? In that way the sea power may cease to be destructive and may become constructive. Presently simple agreements may take the place even of the police of the seas.

In 1817 President Madison and the British Foreign Office made a simple agreement to forbid armaments upon the Great Lakes in order to avoid collision and to save expense. That agreement has kept the peace during the whole period; and yet the annual commerce of the Great Lakes exceeds that of the Mediterranean Sea.

The false theory that international commerce is in any part a war upon domestic industry is intellectually dead. It has no support in this country, except among men whose political convictions have become fossilized or else on the part of those who represent vested interests. The plan of asserting the policy of the "open door" in the East, while closing our own door by prohibitive duties against the West or the East, is becoming as absurd as it is injurious.

A Few Words About War.

BY EDGAR FAWCET.

From the New York World.

The instant that two powers attempt to murder their respective citizens they should be torn asunder by a stronger power — arbitration. There is no element of utopianism in this plan. It is absolutely feasible, and in some respects even more so than was the freeing of our own slaves, and again still more so than was the freeing of the Russian serfs.

Those who cry out against the impracticability of Socialism must find their sharpest conservative javelins blunted when they assail the would-be destroyers of war. There are many wise men to-day who see in human nature itself a mighty obstacle to the exploitation of socialistic creeds. But is there an honest, wise man in the whole world at the present hour who does not believe war a curse infinitely more easy to grapple with and extirpate than that of poverty among the masses?